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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023

HMM1011 – BASIC MICROBIOLOGY

(All sections / Groups)

10 JULY 2023
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 4 pages with 4 Questions only.
2. Answer **ALL THE QUESTIONS**. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers **clearly** and **neatly** in the Answer Booklet provided.

QUESTION 1

- (a) In the mid-1800s, an anesthesiologist named John Snow was conducting a series of investigations in London that warrant him being considered the “father of field epidemiology.” Why was the work by Snow so important in supporting the germ theory and overthrew the idea of miasma? [2 marks]
- (b) Why is immersion oil necessary for the very high magnification microscope objectives? [1 mark]
- (c) Why is acid-fast staining differential? Name TWO examples of bacteria that require acid-fast staining? [2 marks]
- (d) The causative agent of botulism, a deadly form of food poisoning, is an endospore-forming bacterium called *Clostridium botulinum*. Why might it be difficult to kill this bacterium in contaminated food? [1 mark]
- (e) Puerperal fever is a bacterial infection that can occur in the uterine tract of women after giving birth or undergoing an abortion. Ignaz Philipp Semmelweis, a physician in nineteenth century Austria, determined that puerperal fever is contagious and argued that the unhygienic practices of physicians, like examining patients after performing autopsies, caused the spread of puerperal fever.
What did he observe and how did he propose to reduce the occurrence of puerperal fever? [2 marks]
- (f) What are the possible benefits of fermenting foods for ancient peoples? [2 marks]

QUESTION 2

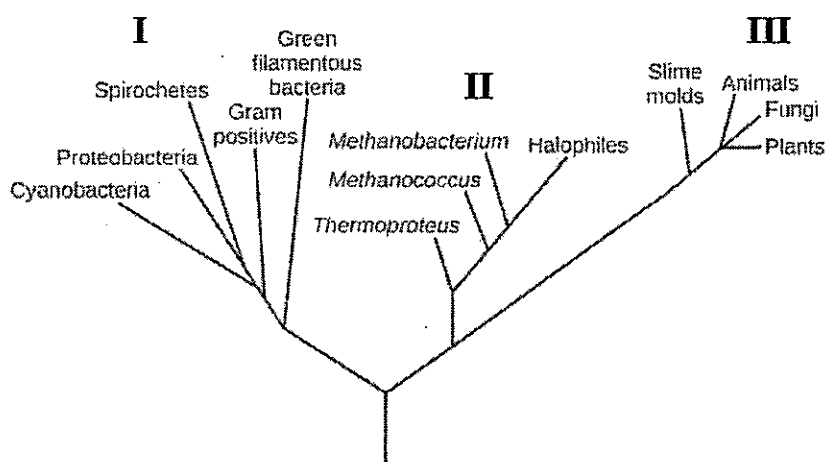
- (a) Name the types of culture media described below: [3 marks]
- Media that inhibit the growth of unwanted microorganisms and support the growth of the organism of interest by supplying nutrients and reducing competition.
 - Media that are intended to cultivate a wide range of microorganisms in an undifferentiated way.
 - Media that make it easy to distinguish colonies of different bacteria by a change in the color of the colonies or the color of the medium.
 - Media that contain growth factors, vitamins, and other essential nutrients to promote the growth of fastidious organisms.
 - Type of medium of which the complete chemical composition of a medium is known.
 - Type of medium which contains extracts and digests of yeasts, meat, or plants, the precise chemical composition of the medium is not known.

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- (b) What structures on the bacteria are targets of antibacterial chemicals? Name at least THREE. [1.5 marks]
- (c) What bacterial structural target would make an antibacterial drug selective for Gram-negative bacteria? [0.5 mark]
- (d) When making turbidity measures of bacterial cultures, what does the turbidity in a broth tube indicate? Why is it important to measure the turbidity of a control tube with only broth in it? [2 marks]
- (e) *Streptococcus mutans* is a major cause of cavities. It resides in the gum pockets, does not have catalase activity, and can be grown outside of an anaerobic chamber. In terms of oxygen requirement, which type of organism would *Streptococcus mutans* be? [1 mark]
- (f) Diseases that involve biofilm-producing bacteria are of serious concern. They are not as easily treated compared with those involving free-floating (or planktonic) bacteria. Explain TWO reasons why biofilm formers are more pathogenic. [2 marks]

QUESTION 3

- (a) Would you expect the oldest bacterial lineages to be aerobic or anaerobic? Why? [1 mark]
- (b) Label the three domains found on modern phylogenetic trees. [1.5 marks]



- (c) A scientist discovers a new single-celled organism.
- If this is all you know, can you place the organism into a particular domain? If so, what is the domain? If not, why not? [1 mark]
 - What type of information could help the scientist classify the organism? Name at least TWO. [1 mark]

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- (d) How would treating an area of a forest with a broad-spectrum fungicide alter the carbon and nitrogen cycles in the area? [1.5 marks]
- (e) Name FOUR ways human benefit from algae. [2 marks]
- (f) Name TWO examples of prion diseases. How do prion diseases replicate? [2 marks]

QUESTION 4

- (a) Koch's postulates, which require the presence of an infectious agent in cases with disease, and its absence in those without, and the isolation of the agent in pure cultures, were initially very important to identify infectious etiologies. However, it had limitations. Name at least TWO scenarios in which Koch's postulates are not applicable. [2 marks]
- (b) During an epidemic, why might the prevalence of a disease at a particular time not be equal to the sum of the incidences of the disease? [2 marks]
- (c) Describe four ways in which pathogens can enter the body. [2 marks]
- (d) Compare and contrast the innate and adaptive immune systems by naming at least THREE differences. [3 marks]
- (e) Why is the immune response after reinfection much faster than the adaptive immune response after the initial infection? [1 mark]

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